RHINONYSSINE NASAL MITE INFESTATIONS IN BIRDS AT MITCHELL RIVER MISSION DURING THE WET AND DRY SEASONS

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Synopsis

The tropical Mitchell River Mission has a sharply defined wet and dry season each year, almost 90% of the annual average rainfall of 48 inches falling between December and March. Collections of birds during each season showed no obvious difference either in terms of absolute numbers or species composition, except for a slightly broader spectrum in the " dry " (59% of the species were seen in both seasons, 25% only in the " dry " and 16% only in the " wet "). Any disparity is explainable by (i) natural factors such as seasonal migration and nomadism ; and (ii) sampling bias : the country is largely impassable in the " wet ", and, paradoxically, it is therefore easier both to collect water-birds in the " dry " and perching birds in the " wet ".

This constancy is paralleled by the rhinonyssine mite populations in the nasal passages of these birds. The same mite genera and species are present in both seasons, and infestation rates and numbers of mites *per* infested bird are constant. Of 108 species of birds examined, 43 had nasal mites ; the proportion in the " wet " was 28/77 and in the " dry " 29/82. Of 841 individual birds examined, 129 had nasal mites ; the proportion in the " wet " was 65/476 and in the " dry " 64/365. The average number of mites in an infested bird was five in the " wet " and four in the " dry ". These overall statistics could reflect the relatively constant microclimate in the warm, moist nasal passages compared with the extremes outside, where noon shade temperatures over 100°F and relative humidities below 20% are common in the " dry ".

A list of the 128 species of birds recorded at the Mission is appended, showing the species recorded, or likely to be recorded as harbouring rhinonyssine nasal mites.

Introduction

The belief of Victorian virologists that Murray Valley encephalitis had infiltrated from north Queensland stimulated a survey of human sera for neutralizing antibodies to MVE. This showed their highest incidence around the Gulf of Carpentaria, and the Mitchell River Mission was selected for intensive study. The virus has since been isolated from mosquitoes caught there, and periodical visits have confirmed the significance of the area, where a field station has recently been opened (20th Annual Report, Queensland Institute of Medical Research, 1965).

In an expansion of this programme, several species of birds have already been shown, by direct isolation of viruses, to act as reservoirs of infection. The study of blood-sucking arthropods other than mosquitoes as possible natural vectors is also contemplated, but this will be hampered for some time by the infant state of systematics in almost all groups concerned. As a beginning, the intranasal mites of birds are receiving attention.

The present note, a comparison of the bird faunas and their intranasal mite populations in the " wet " and the " dry ", is based on 10 weeks intensive field collecting, divided almost equally between the dry seasons (October-November) of 1964 and 1965, and the wet seasons (March-April) of 1965 and 1966. Results to date have been most gratifying, and a wealth of new records and species is under study (Domrow, 1966, and in ms.).

The Locality

To summarize Standfast (1965), the Mitchell River Mission cattle station (15°28′S, 141°40′E) is centred 16 miles from the west coast of Cape York Peninsula in a very flat, low-lying area of tropical tussock grassland and tropical woodland. It is typified by scrubby eucalypts and many coarse grasses, with fresh-water mangrove (*Barringtonia gracilis*)* and cabbage-tree palms (*Livistona australis*) common along the water-courses. The annual rainfall averages 48 inches, of which 42 inches fall between December and March. During the " wet ", the rivers and creeks flood and large areas of low-lying country become fresh-water swamps, which, overgrown with the ubiquitous and very dense and tall grasses, provide a breeding ground for a wide variety of water-birds. During the " dry ", this grass largely dies (or is burnt) away, leaving much bare earth, while the creeks are restricted to a series of water-holes, and the swamps recede to form small lagoons or dry out completely. These residual pools, with their meagre fringe of greenery, become the foci of the activities of large numbers of birds, which come to water throughout the day—this is not surprising as frequently the shade temperature exceeds 100°F and the relative humidity falls below 20% at noon.

The Birds

Tables 1 and 2 are confined to the birds I have actually examined for nasal mites, and provide a comparison between the " wet " and the " dry ". In both, the host data are broken down to ordinal level. Table 1 is concerned with the numbers of species of birds examined and found infested. Table 2 details the total numbers of birds examined, the numbers found infested and the numbers of mites *per* infested bird.

Table 1

Numbers of species of birds examined and found infested with Rhinonyssinae at Mitchell River Mission

Order	Species examined				Species infested			
	" Wet "	" Dry "	Both	Total	" Wet "	" Dry "	Both	Total
Columbiformes	4	4	2	6	3	2	1	4
Gruiformes		1		1				
Podicipiformes		1		1		1		1
Charadriiformes	5	9	4	10	2	4	2	4
Ciconiiformes	10	6	6	10		2		2
Anseriformes	2	6	2	6		1		1
Pelecaniformes	1	2		3				
Falconiformes	6	3	3	6	1	1	1	1
Strigiformes	1	1		2				
Psittaciformes	4	7	4	7	2	3	2	3
Caprimulgiformes	1	1	1	1				
Coraciiformes	6	5	5	6	4	2	1	5
Cuculiformes	6	2	2	6	2	1	1	2
Passeriformes	31	34	22	43	14	12	6	20
Total	77	82	51	108	28	29	14	43

It is evident, both in terms of species composition and absolute numbers of individual birds, that the " wet " fauna parallels the " dry " very closely (there are several large and permanent water-holes in the area), but with a slightly broader spectrum in the " dry ". This is confirmed by consulting the complete list below of the birds now known to occur at Mitchell River: 75 (59%) of the 128 species were listed in both seasons, with 32 (25%) noted only in the " dry " against 21 (16%) only in the " wet ". However, although it is impossible

* Given in error as *Nauclea orientalis* by Standfast.

to give a clear-cut explanation in every case—the predatory and water-bound faunas, for example, while nomadic, are undoubtedly more uniform than indicated—there are two factors which would tend to emphasize this slight difference.

The first comprises real, or natural differences of two main types. The dry season component includes a group of migratory species (*Myristicivora*, *Mesoscolopax*, *Erolia*, *Stiltia*, *Scythrops* and *Myiagra*), which, travelling south in September-October and returning north in March-April, could also be expected at the Mitchell River Mission in the " wet ". However, other members of this group (*Halcyon sancta*, *Cacomantis variolosus* and *Chalcites*) have been noted only in the " wet ", and *Eudynamys* and *Edoliisoma* in both seasons. Also, many (particularly a large group of nectar-feeders, *e.g.*, lorikeets and honey-eaters) are nomadic, being dependent on flowering plants *etc.* : *Barringtonia* and eucalypts were both flowering profusely in the " dry " of 1965. The mistletoe bird, *Dicaeum*, is another example : this small bird " undertakes extensive seasonal movements coincident with the fruiting of the [mistletoe] plants. This may be in spring, summer, autumn, or winter, in different areas " (Keast, 1961).

The second is an unreal difference due to collecting bias. This is the direct result of climatic conditions. In the " wet ", the roads are closed even to light traffic, and the swamps are overgrown with dense grass and reeds in excess of eight feet tall. Tables 1 and 2 bear out the paradoxes that it is easier both to obtain water-birds in the " dry " (95 of 25 species *v.* 55 of 18 species) and perching birds in the " wet " (421 of 59 species *v.* 270 of 57 species). Further, it is impossible to reach the sea by overland in the " wet ", so *Larus*, *Haematopus* and *Haliastur indus* have been noted only in the " dry ".

Their Nasal Mite Parasites

From Tables 1 and 2, the infestation rates (Rhinonyssinae only) are also remarkably similar. Omitting host species examined only in the dry season, and the Cuculiformes, of which only inconclusive numbers were examined, the types of birds infested, the numbers infested and the numbers of mites *per* infested host remain virtually unchanged from the " wet " to the " dry ".

Table 2

A seasonal comparison of infestation rates by Rhinonyssinae in birds at Mitchell River Mission

Order	Number examined		Number infested		Mites/infested bird	
	" Wet "	" Dry "	" Wet "	" Dry "	" Wet "	" Dry "
Columbiformes	32	32	5	4	3(3)	2(2)
Gruiformes		7				
Podicipiformes		2		1		1(1)
Charadriiformes	20	41	5	9	4(3)	6(6)
Ciconiiformes	19	13		2		16(15)
Anseriformes	15	28		1		2(2)
Pelecaniformes	1	4				
Falconiformes	24	8	5	2	6(4)	4(1)
Strigiformes	1	1				
Psittaciformes	62	61	4	6	4(–)	4(4)
Caprimulgiformes	1	2				
Coraciiformes	44	18	15	2	4(3)	10(–)
Cuculiformes	17	4	2	1	20(–)	1(1)
Passeriformes	240	144	29	36	4(4)	3(2)
Total	476	365	65	64	5(3)	4(3)

In the final column, unbracketed figures are derived from the total number of mites present ; bracketed figures apply only to sexually mature mites—the adjustment is not great. Dashes indicate that figures are unavailable, certain common mites having been deep-frozen in the field for subsequent inoculation studies. The bracketed figures for Passeriformes are, for this reason calculated from only 26 birds in the " wet " and 31 in the " dry ".

The constancy in seasonal occurrence of birds extends to the genera and species of their mite parasites, which are now treated under an ordinal arrangement of those hosts known to occur in both seasons. Host-specificity is marked in the Rhinonyssinae.

Double rhinonyssine infestations, while not unknown elsewhere in Queensland (Domrow, unpublished data), have not been noted at Mitchell River, although occasional mixed infestations—Rhinonyssinae (Mesostigmata) and Speleognathinae (Prostigmata)—are on record. However, speleognathines tend to inhabit portions of the nasal cavities different from those preferred by rhinonyssines.

Columbiformes : The two species of mites recorded (*Mesonyssus geopeliae* and *M. ocyphabus*) are members of a widespread and characteristic group of *Mesonyssus* species peculiar to pigeons (Fain, 1962 ; Wilson, 1964 ; Domrow, 1965).

Charadriiformes : Both genera and species of mites noted (*Rhinonyssus himantopus* and *Larinyssus benoiti*) are widespread parasites of waders (Strandtmann, 1959 ; Domrow, 1966).

Falconiformes : The one species collected, *Ptilonyssus cerchneis*, also occurs in falcons in Africa, U.S.A. and U.S.S.R. (Fain, 1957 ; Strandtmann, 1962 ; Bregetova, 1964).

Psittaciformes : All three species of mites recorded (*Mesonyssus trichoglossi*, *M. kakatuae* and *M. aprosmicti*) are members of a group of *Mesonyssus* species restricted to this order of birds (Wilson, 1964 ; Domrow, 1964).

Coraciiformes : The two species of *Mesonyssus* (*M. daceloae* and *M. halcyonus*) recorded from Alcedinidae are close relatives of the species known from African members of this family (Fain, 1957, 1960 ; Domrow, 1965). *Merops*, a bee-eater (Meropidae), is parasitized by a species of *Ptilonyssus*, *P. triscutatus*, previously known from this host genus only in Europe and Africa (Fain, 1957).

Cuculiformes : The species of *Sternostoma*, *S. cuculorum*, taken from cuckoos at Mitchell River was originally recorded from the same host family in Africa (Fain, 1957).

Passeriformes : Apart from *Sternostoma thienponti* and *Sternostoma* sp. from *Cracticus* and *Neositta* respectively, and *Ruandanyssus* sp. from *Artamus*, the remaining 13 species from 17 birds belong to *Ptilonyssus* (or the closely related *Passeronyssus*). These will not be listed in detail, but where overseas hosts have been recorded for these species, they have been closely related indeed to the Australian ones.

Discussion

One explanation for this remarkable constancy of parasite populations throughout the year would seem to lie in the clemency of the warm, moist microclimate afforded by the nasal passages of the host, compared with the extremes outside. On the other hand, with small arthropods bound absolutely to water, *e.g.*, mosquitoes, the wet season fauna differs radically from the dry, when standing waters stagnate and specialized habitats such as temporary pools, tree-holes and leaf axils dry out.

From Table 2 it was seen that the incidence of immature stages in both the " wet " and the " dry " was low, necessitating only minor adjustment to the overall numbers of mites *per* infested host to express their presence. Both sets of figures are given, however, to stimulate enquiry into the question whether the mite populations fluctuate at other times of the year. Further, the tenacity with which these delicate, weakly sclerotized mites keep to their specific microhabitat (see *Addendum*), coupled with their low numbers at the periods studied, presents the possibility that the restricted collecting periods may have tapped only maintenance populations, and not have coincided with reproduction peaks.

A List of Mitchell River Birds

As both the wet (W) and dry (D) seasons are considered above, my own data have been slightly augmented by the incorporation of Standfast's preliminary list (1965) of the dry season fauna, on which I have the following comments.

It is doubtful if more than one species of crow (*Corvus cecilae*) occurs at the Mission : eye-colour varies tremendously from white, through parti-coloured (blue and white), to dense blue-black, while the down of all specimens is uniformly white. With this one deletion (*C. bennetti*), I have had a further 41 of Mr. Standfast's species in the hand and would accept them, with two reservations.

Firstly, the smaller of the two species of cuckoo-shrikes occurring at the Mission admittedly appears white-breasted in the field, but in the hand it is distinctly grey-tinted and identifiable as *Coracina papuensis* rather than *C. hypoleuca*.

Secondly, the birds pointed out to me by Mr. Standfast as " banded plovers " proved in the hand to be Australian pratincoles (*Stiltia isabella*), not *Zonifer tricolor*.

Of the remaining 15 species, I can confirm seven by sighting, track or call (*Dromaius*, *Burhinus*, *Xenorhynchus*, *Pelecanus*, *Haliastur indus*, *Falco cenchroides* and *Scythrops*), but have not noted the others (*Alectura*, *Phaps*, *Porphyrio*, *Dupetor*, *Alcyone*, *Cyrtostomus*, *Aegintha* and *Ptilonorhynchus*).

I can now add another three orders (Podicipiformes, Strigiformes and Caprimulgiformes) and 72 species to this list. Of these, five (*Synoicus*, *Larus*, *Haematopus*, *Himantopus* and *Notophoyx pacifica*) are based on adequate sightings in the field and the remainder on specimens in the hand. These latter, in cases of doubt, were sent to the Queensland Museum, where Mr. D. P. Vernon kindly checked them against reference skins. I do not think many species, at least of land birds, remain undetected in the area, but I have glimpsed snipe, swifts, swallows and possibly a fantail. The following arrangement is that of the 9th edition [1958] of Leach's *An Australian Bird Book*. The rhinonyssine mite species printed in italics have been recorded at Mitchell River, while those in Roman type may be expected to occur there, having been recorded from the indicated host elsewhere in Australia (or New Guinea in the case of *Anas superciliosa*, see Wilson, 1964).*

Casuariiformes		
Dromaius novaehollandiae	WD	
Galliformes		
Alectura lathami	D	
Synoicus australis	WD	
Columbiformes		
Myristicivora spilorrhoa	D	*Mesonyssus* sp. " *A* "
		Mesonyssus sp. " *B* "
Geopelia placida	WD	*Mesonyssus geopeliae*
Geopelia cuneata	WD	
Geopelia humeralis	WD	*Mesonyssus geopeliae*
Phaps chalcoptera	D	Mesonyssus phabus
Geophaps scripta	W	*Mesonyssus ocyphabus*
Ocyphaps lophotes	W	*Mesonyssus ocyphabus*
		Mesonyssus columbae
Gruiformes		
Porphyrio melanotus	D	
Grus rubicundus	WD	

* Since writing this, I again visited Mitchell River for three weeks in October-November 1966, adding eight more species to the list, making 136 in all. These additions are indicated by " d " in the central column.

Podicipiformes		
Podiceps ruficollis	D	*Rhinonyssus poliocephali*
Charadriiformes		
Chlidonias hybrida	WD	
Sterna bergii	d	*Larinyssus orbicularis*
Larus novaehollandiae	D	
Haematopus ostralegus	D	
Erythrogonys cinctus	D	*Rhinonyssus himantopus*
Lobibyx miles	WD	*Rhinonyssus himantopus*
Charadrius alexandrinus	d	Rhinonyssus coniventris *Rhinonyssus mirutus*
Charadrius melanops	WD	*Rhinonyssus himantopus*
Himantopus leucocephalus	D	*Rhinonyssus himantopus*
Recurvirostra novaehollandiae	d	
Numenius madagascariensis	d	
Mesoscolopax minutus	D	
Limosa limosa	W	
Erolia ruficollis	d	*Rhinonyssus* sp.
Erolia acuminata	D	
Irediparra gallinacea	WD	
Stiltia isabella	D	*Larinyssus benoiti*
Burhinus magnirostris	WD	
Eupodotis australis	WD	
Ciconiiformes		
Threskiornis molucca	WD	
Threskiornis spinicollis	WD	
Plegadis falcinellus	WD	
Platalea regia	W	
Platalea flavipes	W	
Xenorhynchus asiaticus	D	
Egretta intermedia	Wd	
Egretta alba	WD	
Notophoyx novaehollandiae	WD	*Mesonyssus belopolskii*
Notophoyx pacifica	Wd	
Notophoyx picata	WD	*Mesonyssus belopolskii*
Nycticorax caledonicus	WD	
Dupetor flavicollis	D	
Anseriformes		
Anseranas semipalmata	WD	
Nettapus pulchellus	WD	
Dendrocygna arcuata	D	*Rhinonyssus rhinolethrus*
Tadorna radjah	WD	
Anas superciliosa	D	Rhinonyssus rhinolethrus
Anas gibberifrons	D	
Pelecaniformes		
Phalacrocorax sulcirostris	WD	
Phalacrocorax melanoleucus	WD	
Anhinga novaehollandiae	WD	
Pelecanus conspicillatus	WD	
Falconiformes		
Accipiter fasciatus	Wd	
Aquila audax	WD	
Haliaeetus leucogaster	WD	
Haliastur sphenurus	WD	
Haliastur indus	D	
Milvus migrans	WD	
Falco berigora	WD	*Ptilonyssus cerchneis*
Falco cenchroides	WD	Ptilonyssus cerchneis
Strigiformes		
Ninox novaeseelandiae	W	Rhinoecius cooremani
Ninox connivens	D	

PSITTACIFORMES

Trichoglossus moluccanus	WD	*Mesonyssus trichoglossi*
Psitteuteles versicolor	D	
Calyptorhynchus banksi	WD	*Mesonyssus kakatuae*
Kakatoe galerita	WD	
Kakatoe roseicapilla	WD	Mesonyssus kakatuae
Kakatoe sanguinea	D	
Aprosmictus erythropterus	WD	*Mesonyssus aprosmicti*

CAPRIMULGIFORMES

Podargus strigoides	WD	

CORACIIFORMES

Eurystomus orientalis	WD	
Alcyone azurea	D	
Dacelo leachi	WD	*Mesonyssus daceloae*
Halcyon pyrrhopygia	WD	*Mesonyssus halcyonus*
Halcyon sancta	W	*Mesonyssus halcyonus*
Halcyon macleayi	WD	*Mesonyssus halcyonus*
Merops ornatus	WD	*Ptilonyssus triscutatus* Sternostoma cooremani

CUCULIFORMES

Cuculus saturatus	W	
Cacomantis pyrrhophanus	WD	*Sternostoma cuculorum*
Cacomantis variolosus	W	*Sternostoma cuculorum*
Chalcites plagosus	Wd	
Scythrops novaehollandiae	D	
Eudynamys orientalis	WD	
Centropus phasianinus	WD	

PASSERIFORMES

Hirundo neoxena	d	*Cas angrensis* *Ptilonyssus echinatus*
Microeca fascinans	WD	*Ptilonyssus microecae*
Microeca flavigaster	WD	*Ptilonyssus microecae*
Rhipidura leucophrys	WD	*Ptilonyssus macclurei* *Sternostoma laniorum*
Myiagra rubecula	D	Sternostoma laniorum Ruandanyssus terpsiphonei
Seisura inquieta	D	Ptilonyssus terpsiphonei
Coracina novaehollandiae	WD	Ruandanyssus terpsiphonei
Coracina papuensis	WD	
Edoliisoma tenuirostre	WD	
Lalage tricolor	WD	*Ptilonyssus cractici* *Ruandanyssus terpsiphonei*
Smicrornis flavescens	Wd	
Gerygone palpebrosa	WD	Ptilonyssus sp.
Cisticola exilis	WD	
Malurus melanocephalus	WD	Ptilonyssus maluri
Artamus cinereus	WD	*Ruandanyssus* sp.
Grallina cyanoleuca	WD	*Ptilonyssus grallinae*
Pachycephala rufiventris	WD	*Ptilonyssus motacillae* Ruandanyssus terpsiphonei
Gymnorhina tibicen	Wd	Ptilonyssus cractici Sternostoma thienponti
Cracticus nigrogularis	WD	*Sternostoma thienponti*
Cracticus quoyi	WD	Sternostoma thienponti
Neositta striata	W	*Sternostoma* sp.
Climacteris melanota	d	
Dicaeum hirundinaceum	D	Ptilonyssus dicaei
Pardalotus rubricatus	W	
Cyrtostomus frenatus	D	Ptilonyssus cinnyris
Melithreptus albogularis	W	*Ptilonyssus meliphagae*
Myzomela pectoralis	WD	*Ptilonyssus gliciphilae*
Gliciphila fasciata	D	
Gliciphila indistincta	D	*Ptilonyssus gliciphilae*
Conopophila albogularis	d	
Meliphaga fusca	W	
Meliphaga flava	WD	*Ptilonyssus stomioperae*

Stomiopera unicolor	WD	*Ptilonyssus stomioperae*
Entomyzon cyanotis	WD	*Ptilonyssus philemoni*
Philemon citreogularis	D	*Ptilonyssus philemoni*
Mirafra javanica	WD	*Ptilonyssus capitatus*
Steganopleura bichenovii	WD	
Donacola castaneothorax	WD	
Aegintha temporalis	D	
Bathilda ruficauda	W	
Poephila atropygialis	WD	
Poephila personata	WD	
Poephila gouldiae	W	Sternostoma tracheacolum
Oriolus flavocinctus	WD	*Ptilonyssus trouessarti*
Sphecotheres flaviventris	WD	Ptilonyssus sphecotheris
Chibia bracteata	WD	*Passeronyssus dicruri*
Ptilonorhynchus violaceus	D	
Chlamydera nuchalis	WD	*Ptilonyssus sphecotheris*
Corvus cecilae	WD	

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Addendum

Since writing the above, it has become desirable to explain the method of collection, and to detail the parasitope of these mites. All the material was taken after the classical method outlined by Fain (1957), the premier student of these mites : " *La récolte des Acariens a été pratiquée généralement peu de temps après la mort de l'Oiseau . . . le bec est largement ouvert. Au moyen d'une paire de ciseaux à mors fins on découpe le palais, le plus près possible du bec et sur une grande longueur de façon à bien exposer la région qui correspond aux narines. Les tissus excisés sont . . . examinés ultérieurement . . . Pour examiner les narines par l'intérieur il est souvent nécessaire de disséquer les cornets situés profondément ou les lamelles cornées qui cachent plus ou moins leur orifice interne . .*

Les Rhinonyssidés vivent . . . dans les narines, on peut cependant les rencontrer aussi dans le mucus qui recouvre les cornets, mais ils ne s'aventurent jamais très loin à l'intérieur des fosses nasales . . . les Rhinonyssidés sont animés de mouvements lents et ne se déplacent probablement que très peu."

The same author (1965, *Ann. Parasit. hum. comp.*, 40 : 317-327) continues : "*De toutes les formes d'acariase interne, la plus répandue est celle des voies respiratoires. On la rencontre principalement chez les Mammifères et les Oiseaux, mais elle existe aussi chez les Serpents, les Batraciens et même chez certains Invertébrés tels que les Mollusques pulmonés . . . Tous ces Acariens des voies respiratoires sont spécifiques, non seulement en ce qui concerne l'hôte, mais encore pour la région souvent très limitée qu'ils occupent dans l'appareil respiratoire . . . Les Acariens de la . . . famille . . . des* Rhinonyssidae *sont hématophages comme la plupart des Mésostigmates ectoparasites dont ils dérivent probablement. On les rencontre . . . dans les régions antérieures des fosses nasales, mais uniquement sur les parties les plus vascularisées des cornets. Une espèce cependant* (Sternostoma tracheacolum *a envahi les bronches et les poumons où elle se nourrit d'ailleurs également de sang.*"

Any tendency, therefore, based only on clinical veterinary experience with this species (it causes severe respiratory complications in cage birds, see Murray, 1966, *Aust. vet. J.*, 42 : 262-264), to believe that rhinonyssine mites in general are endoparasites whose major populations occur in the deeper respiratory organs (tracheae, bronchi, lungs and air sacs), with only the fringe of those populations evident in the nasal passages, should be resisted. Avian nasal mites are just that, and all specialists I have questioned on this point agree, having dissected birds in the field, that rhinonyssines are not found, except as rarities and *S. tracheacolum* apart, in the internal respiratory tract (see also Maa and Kuo, 1965, *J. med. Ent.*, 1 : 395-401).

By this method it is possible to collect virtually every mite present in the nasal passages of each bird. The population data given above are therefore both quantitative and at least suggestive that the populations of these delicate mites are independent of the two major macroenvironmental factors, relative humidity and temperature. Nor does it seem likely that these factors would affect the mite populations by way of their hosts, since avian organ systems are capable of considerable physiological regulation, even in extreme climatic conditions (Thomson, 1964, " A New Dictionary of Birds ", Nelson, London—see entries on drinking, excretion, heat regulation, respiratory system, *etc.*).

To conclude, rhinonyssine mites are essentially the sole occupants of a specialized parasitope affording an unchanging microclimate and a food supply of constant quality. Reasonably stable populations are therefore not inconsistent with this situation. However, I know of no published data to support this, and so let the original text stand.

Corrigenda

These Proceedings, Vol. 90, Part 2, page 199, line 11 from bottom, *for* " pale-yellow robin, *Eopsaltria capito* " *read* " lemon-breasted flycatcher, *Microeca flavigaster* ". Page 208, line 9, *for* " *Callistemon* " *read* " *Barringtonia gracilis* ". Also amend host data accordingly in *Synopsis* and captions to Figs 28 and 29.